REMARKS

Applicant respectfully requests further examination and reconsideration in view of the arguments set forth fully below. Claims 1-4, 14, 16, 17, 143 and 144 were previously pending in the instant application. Within the Office Action Claims 1-4, 14, 16, 17, 143 and 144 have been rejected. Claims 1-4, 14, 16, 17, 143 and 144 remain pending in this application.

Fundamentals of the Technology

The present invention relies in part on a piezo transducer. As is known, such transducers can be excited by traveling waves or by standing waves. When excited by traveling waves, all portions of the transducer will experience moments of expansion and contraction. In contrast, when a transducer is excited in resonance the transducer will experience a standing wave. When a standing wave is present, portion of the transducer will expand and contract while other portions of the transducer will experience substantially no change in dimension. In the specification, the regions that experience substantially no change in dimension are referred to as the "anti-nodal regions." When a transducer is not operating in resonance, it cannot have nodal or anti-nodal regions. Operating a device other than in resonance cannot achieve the method of the present invention, in part because all portions of the transducer will expand and contract at their respective appropriate time. However, by operating the transducer in resonance will induce portions of the device to expand and contract in thickness while other portions of the device (the anti-nodal regions) cannot substantially expand and contract. By only having contact in the anti-nodal regions of the transducer, only lateral and no vertical motion is imparted. **No prior art reference considers, teaches, hints, suggests or takes advantage of transducers operating in resonance wherein contact is made substantially only in regions where there is substantially no vertical motion imparted by the transducer to the load.**

Rejection Under 35 USC 112

Within the Office Action, Claim 144 was rejected under 35 U.S.C. 112 as being indefinite. The Office Action states that the claim is either inaccurate or based on an inadequate disclosure based on the Applicant's remarks made in response to the Office Action mailed August 22, 2003. Specifically, within the Office Action, it refers to the language in the Claim, "no motion perpendicular to the second surface is imparted to the second surface," and the comments on page 4, paragraph 2 in the response to the Office Action dated August 22, 2003.

The Applicant remarks that the first surface undergoes maximum vertical displacement in the nodal region and conversely minimal vertical displacement in the anti-nodal regions. Claim 144 teaches placing the first surface at an appropriate distance from the first element. Therefore, no motion from the first element will be or can be imparted perpendicular to the second surface. Therefore, Claim 144 is properly supported by the specification.

Rejection Under 35 USC 102(a)

Within the Office Action, Claims 1-4 and 143 have been rejected under 35 U.S.C. 102(a) as being anticipated by U.S. Patent No. 4,736,129 to Endo, et al. (hereafter "Endo"), U.S. Patent No. 5,043,621 to Culp (hereafter "Culp"), U.S. Patent No. 5,432,120 to Assard, et al. (hereafter "Assard"), U.S. Patent No. 4,884,002 to Eusemann, et al. (hereafter "Eusemann") or U.S. Patent No. 5,345,137 to Funakubo, et al. (hereafter "Funakubo").

The Office Action references Figures 1 and 3a with regards to Endo, Figures 8 and 12 with regards to Culp, Figures 4 and 5 with regards to Assard, Figures 1 and 1a with regards to Eusemann and Figures 27, 31 and 32 with regards to Funakubo. Specifically, within the Office Action, it is stated that each previous invention shows a second surface, a first surface and a contact pad, wherein a symmetrical motion is induced in the first surface parallel to the interface. The Applicants respectfully traverse the rejection.

Endo teaches an ultrasonic motor driven by the vibration of a piezoelectric element. Endo teaches that a wave propagates in an elastic member, parallel to the sliding member interface in an elliptical motion resulting in the individual material particles of the sliding member to move in an elliptical motion. This wave results in the motion of the sliding member sliding along the elastic member. Endo does not teach exciting the piezoelectric element in resonance thereby causing standing waves and anti-nodal regions. As such, Endo must impart perpendicular motion to the load.

In contrast to the teachings of Endo, the present invention is directed to a method of controlling the effective coefficient of friction between a first surface of a first element and a second surface of a second element. Contact pads are in place at anti-nodal regions on the first element where there is no vertical displacement. A symmetrical motion is induced in the first element. Endo fails to teach of contact pads in the anti-nodal regions. Further, Endo fails to teach or suggest reducing the effective coefficient of friction. In contrast to the present invention, Endo is creating an elliptical motion in the sliding member.

Culp teaches a piezoelectric device used to effect motion in an object. Culp teaches that the application of current to the first surface causes the second surface to move a distance proportional to the current applied and in a direction parallel to its surface. Culp does not teach exciting the piezoelectric element in resonance thereby causing standing waves and anti-nodal regions.

Assard teaches a dithering device which creates movement in a circular plane. Assard teaches a system with piezoelectric members attached to a support base at the bottom and to a jewel bearing at the top. Through application of current, some members move in the x direction and others move in the y direction. The combined movements result in a circular motion of the jewel bearing. Assard does not teach exciting the piezoelectric element in resonance thereby causing standing waves and anti-nodal regions.

Eusemann teaches an armature for use in motors that is driven by a piezoelectric element

and a drive pin set at an angle relative to the perpendicular to the contact portion of the friction surface. Eusmann does not teach exciting the piezoelectric element in resonance thereby causing standing waves and anti-nodal regions.

In contrast to Culp, Assard and Eusemann, the present invention is directed to a method for reducing the effective coefficient of friction between a first and a second first. Contact pads are put in place as the interface between the first and second surface at antinodal regions. A symmetrical motion is induced in the first surface resulting in a reduction of the effective coefficient of friction, without effecting the actual coefficient of friction. The previous inventions, in contrast, do not have contact pads, but rather have a complete interface between the surface of the first and second elements. Therefore, any motion in the first element causes the second element to move relative to the first. As described above, each of the previous inventions is directed at creating motion in the second element. The previous inventions fail to teach to teach of using contact pads or using the nodal and antinodal regions.

Funakubo teaches a two-dimensional driving ultrasonic motor. The motor uses a piezoelectric device for creating a vibration. Funakubo teaches in Figures 27, 31, 32 an ultrasonic vibrator in contact with a sliding member, with a hemispherical friction member at the interface. Vibration is created in the x and y direction and in an elliptical motion. This causes motion in the sliding member. Funakubo does not teach exciting the piezoelectric element in resonance thereby causing standing waves and anti-nodal regions.

In contrast to Funakubo, the present invention is directed to a method of controlling an effective coefficient of friction between a first surface of a first element and a second surface of a second element. By placing contact pads at the anti-nodal regions of the first surface, the second surface does not move relative to the first surface. Funakubo fails to teach of reducing the effective coefficient of friction and fails to teach or suggest of using contact pads at the anti-nodal regions.

Specifically, the independent Claim 1 is directed to a method of controlling an effective coefficient of friction between a first surface of a first element and a second surface of a second element. The method comprises configuring the first and second surfaces to be in slidable contact with one another along an interface of a contact pad surface between the first surface and the second surface under a force sufficient to maintain contact and having static friction therebetween and inducing a repetitive motion in the first surface parallel to the interface thereby altering the effective coefficient of friction along the contact pad surface. As described above, Endo, Culp, Assard, Eusemann and Funakubo fail to teach or suggest a method for reducing the effective coefficient of friction by inducing a repetitive motion. Each previous invention is directed at creating motion in the second surface relative to the interface with the first surface. The previous inventions further fail to teach of using a contact pad surface between the first and second surface. For at least these reasons, the independent Claim 1 is allowable over the teachings of Endo, Culp, Assard, Eusemann and Funakubo .

The independent Claim 2 is directed to a method of controlling an effective coefficient of friction between a first surface of a first element and a second surface of a second element. The method comprises configuring the first and second surfaces to be in slidable contact with one another along an interface of a contact pad surface between the first surface and the second surface under a force sufficient to maintain contact and having static friction therebetween and inducing a symmetrical motion in the first surface parallel to the interface thereby altering the effective coefficient of friction along the contact pad surface. As described above, Endo, Culp, Assard, Eusemann and Funakubo fail to teach or suggest a method for reducing the effective coefficient of friction by inducing a symmetrical motion. Each previous invention is directed at creating motion in the second surface relative to the interface with the first surface. The previous inventions further fail to teach of using a contact pad surface between the first and second surface. For at least these reasons, the independent Claim 2 is allowable over the teachings of Endo, Culp, Assard, Eusemann and Funakubo .

Claims 3 and 4 are dependent on the independent Claim 2. As described above, the independent Claim 2 is allowable over the teachings of Endo, Culp, Assard, Eusemann and Funakubo . Accordingly, Claims 3 and 4 are also allowable as being dependent on an allowable base claim.

The independent Claim 143 is directed to a method of controlling an effective coefficient of friction between a first surface of a first element and a second surface of a second element. The method comprises configuring the first and second surfaces to be in slidable contact with one another along an interface between the first surface and the second surface, wherein the interface is located only along an anti-nodal region of the first element, the first and second surfaces under a force sufficient to maintain contact at the interface and having a static friction therebetween and inducing a repetitive motion in the first surface parallel to the interface thereby altering the effective coefficient of friction. As described above, Endo, Culp, Assard, Eusemann and Funakubo fail to teach or suggest a method for reducing the effective coefficient of friction by inducing a symmetrical motion. Each previous invention is directed at creating motion in the second surface relative to the interface with the first surface. The previous inventions fail to teach of using a contact pad surface between the first and second surface. The present inventions further fail to teach using the anti-nodal region as the interface between the first and second surface. For at least these reasons, the independent Claim 143 is allowable over the teachings of Endo, Culp, Assard, Eusemann and Funakubo .

Within the Office Action, Claim 144 has been rejected under 35 U.S.C. 102(a) as being anticipated by Culp, Assard, or Eusemann. Specifically, it is stated within the Office Action, the references appear to impart zero or minimal vertical movement.

As described above, Culp (Figure 8), Assard (Figure 1, 4, 5) and Eusemann (Figure 1) teach a first surface that is in complete contact with a second surface. Therefore in the previous inventions, a translation in the first surface results in a commensurate translation in the second

surface. In contrast to Culp, Assard and Eusemann, the present invention is directed to a method for reducing the effective coefficient of friction between a first and a second surface. The present invention uses contact pads as the interface between the first and second surface. Therefore, the first and second surface are not put in complete contact. The contact pads are situated such that motion in the first surface is not imparted to the second surface. The contact area remains constant and the second element does not move relative to the first element. The previous inventions further fail to teach or suggest of using the nodal and anti-nodal regions.

Specifically, independent Claim 144 is directed to a method of controlling an effective coefficient of friction between a first surface of a first element and a second surface of a second element. The method comprises configuring the first and second surfaces to be in slidable contact with one another along an interface wherein the first surface protrudes from the first element an appropriate distance such that no motion perpendicular to the second surface is imparted to the second surface and inducing a repetitive motion in the first surface parallel to the interface thereby altering the effective coefficient of friction, wherein the static friction force is unaltered. As described above, the teachings of Culp, Assard and Eusemann present a first surface that is in complete contact with a second surface. Therefore any motion in the first surface is imparted on the second surface. The previous inventions fail to teach or suggest a method of using the antinodal regions to reduce the effective coefficient of friction. For at least these reasons, the independent Claim 144 is allowable over the teachings of Culp, Assard and Eusemann.

It is stated within the Office Action that Claim 143 is rejected under 35 U.S.C. 102 (a) as being anticipated by U.S. Patent No. 5,416,375 to Funakubo, et al. (hereafter "Funakubo/375"), U.S. Patent No. 5,917,268 to Takagi (hereafter "Takagi") or U.S. Patent No. 5,936,328 to Takano, et al. (hereafter "Takano").

Specifically, the Office Action references Figure 2 with regards to Funakubo/375, Figure 3 with regards to Takagi and Figures 6 and 7d with regards to Takano. Within the Office Action it states that the references show pads coupled only at anti-nodes. The applicant respectfully traverses the rejection.

Funakubo/375 teaches an ultrasonic motor. The motor comprises an elastic body with piezoelectric bodies clamped to it. An elliptical oscillation is generated in the elastic body, resulting in a sliding member moving with respect to the ultrasonic oscillator.

Takagi teaches a vibration driven motor. The motor comprises a first element with an electro-mechanical converting element adhered on its upper surface and sliding members adhered to its lower surface. When voltage is applied to the electro-mechanical converting elements, the vibration creates elliptical motions in the sliding members. This results in a second element moving relative to the first element. The driving direction of the motor is changed by changing the frequency of the vibrations produced in an electro-mechanical converting element. The motor has a two-dimensional driving direction.

Takano teaches a vibration driven motor. The invention comprises an electro-mechanical

energy conversion element that create vibrations and movement in driving pieces. The vibrations then result in a driving force of a second element. The driving pieces are placed in specific locations to create the driving force.

In contrast to Funakubo/375, Takagi and Takano, the present invention is directed to a method for reducing the effective coefficient of friction between a first and a second first. Contact pads are placed at anti-nodal locations and repetitive motion is induced in the first surface. The second surface does not move relative to the first movement. The previous inventions fail to teach of placing contact pads in anti-nodal regions to reduce the effective coefficient of friction.

Independent Claim 143 is directed to a method of controlling an effective coefficient of friction between a first surface of a first element and a second surface of a second element. As described above, the previous inventions fail to teach of placing contact pads in the anti-nodal regions to reduce the effective coefficient of friction. Further, the previous inventions are used to create a relative motion in the second element. For at least these reasons, the independent Claim 143 is allowable over the teachings of Funakubo/375, Takagi and Takano.

Rejection Under 35 USC 103(a)

It is stated within the Office Action that Claim 14, 16 and 17 is rejected under 35 U.S.C. 103(a) as being anticipated by Culp, Endo or Assard in view of Kamigaito et al. Claims 14, 16 and 17 are dependent on an allowable independent Claim 2. As described above the independent Claim 2 is allowable over the teachings of Culp, Endo and Assard. Accordingly, Claims 14, 16 and 17 are also allowable as being dependent on an allowable base claim.

The Applicants respectfully submit that the claims are now in a condition for allowance in light of the above arguments, and allowance at an early date would be appreciated. Should the Examiner have any questions or comments, she is encouraged to call the undersigned at (408) 530-9700 to discuss the same so that any outstanding issues can be expeditiously resolved.

Respectfully submitted,
HAVERSTOCK & OWENS LLP

Dated: 7-19-04

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CERTIFICATE OF MAILING (37 CFR§ 1.8(a))

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